We claim:

1. An energy management system operable in three modes of operation including a driving mode to drive a vehicle drive shaft, a retarding mode to retard said vehicle drive shaft and a neutral mode to have no driving or retarding influence on said vehicle drive shaft, said system comprising an energy accumulator operable to store and release energy through receipt and release of fluid, a pump having a pump drive shaft and being in fluid communication with said energy accumulator, a reservoir of fluid in communication with said pump, and a coupler adapted to couple said pump to said vehicle drive shaft, whereby in said retarding mode, said vehicle drive shaft drives said pump to pump fluid to said energy accumulator, and whereby in said driving mode, said energy accumulator releases fluid to drive said pump which drives said vehicle drive shaft, and whereby in said neutral mode, said pump is inoperative to exert any driving or retarding influence on said vehicle drive shaft, the system further including at least one sensor adapted to provide input signals indicative of selected system parameters including vehicle ground speed, and a controller incorporating a microprocessor adapted to regulate the modes of operation of said pump and said accumulator in response to said input signals.

2. An energy management system according to claim 1, wherein said pump includes an axial piston hydraulic pump.

3. An energy management system according to claim 1 or claim 2, wherein said pump includes a tiltable swash plate whereby an effective displacement of the pump is selectively variable.

4. An energy management system according to claim 1, wherein said pump includes a radial piston hydraulic pump.

5. An energy management system according to claim 1, wherein said pump includes at least three external ports for ingress and egress of fluid, a first of said ports communicating with an inlet of said fluid reservoir, a second of said ports communicating with an outlet of said fluid reservoir and a third of said ports communicating with said accumulator.

6. An energy management system according to claim 5, wherein said pump includes at least two discrete pump units sharing a common pump drive shaft.

7. An energy management system according to claim 6, wherein said discrete pump units are mounted in back-to-back relationship with direct internal connection of at least one pair of corresponding ports.

8. An energy management system according to claim 5, wherein a heat exchanger is disposed between said first port and said fluid reservoir.

9. An energy management system according to claim 1, wherein said coupler connects said pump drive shaft to said vehicle drive shaft through an intermediate drive transmission mechanism.

10. An energy management system according to claim 9, wherein the drive transmission mechanism defines an effective transmission ratio adapted to provide optimum pumping efficiency over a predetermined range of operating parameters.

11. An energy management system according to claim 9 or claim 10, wherein the drive transmission mechanism includes a gear train, incorporating a first drive gear connected to the vehicle drive shaft and a second drive gear connected to the pump drive shaft.

12. An energy management system according to claim 11, wherein the first and second drive gears are supported for meshing engagement within a pump transfer case.

13. An energy management system according to claim 12, wherein pump is mounted directly to the pump transfer case.

14. An energy management system according to claim 12, wherein the pump is connected indirectly to the pump transfer case via an intermediate shaft or universal coupling.

15. An energy management system according to claim 1, wherein the coupler is adapted to connect the pump drive shaft to the vehicle drive shaft via part of a primary transmission system of the vehicle.

16. An energy management system according to claim 15, wherein the coupler is adapted to connect the pump drive shaft to an output shaft of the primary transmission system of the vehicle.

17. An energy management system according to claim 15, wherein the coupler is adapted to connect the pump drive shaft to an idler shaft in a gearbox transfer case forming part of the primary transmission system of the vehicle.

18. An energy management system according to claim 17, wherein the pump drive shaft is connected directly to the idler shaft through the gearbox transfer case such that the idler shaft and the pump drive shaft are substantially coaxial.

19. An energy management system according to claim 17, wherein the pump drive shaft is connected indirectly to the idler shaft through the gearbox transfer case, via a pump transfer case, such that the idler shaft and the pump drive shaft are axially displaced from one another.

20. An energy management system according to claim 15, wherein the coupler is adapted to connect the pump drive shaft to a power take-off from the primary transmission system of the vehicle.

21. An energy management system according to claim 11, wherein the gear train is configured to permit selection of at least two different transmission ratios between the vehicle drive shaft and the pump drive shaft.

22. An energy management system according to claim 9, wherein the drive transmission mechanism includes a clutch, being engageable to transmit drive between the vehicle drive shaft and the pump drive shaft in the drive and retardation modes, and being disengageable to permit independent rotation of the vehicle drive shaft and the pump drive shaft in the neutral mode.

23. An energy management system according to claim 22, wherein the clutch is coaxial with the pump drive shaft.

24. An energy management system according to claim 22 or claim 23, wherein the clutch is disposed coaxially around one end of the pump drive shaft.

25. An energy management system according to claim 1, wherein the vehicle drive shaft and the pump drive shaft are substantially parallel.

26. An energy management system according to claim 1, wherein the pump drive shaft is inclined with respect to the vehicle drive shaft.

27. An energy management system according to claim 22, wherein the clutch includes a first clutch member non-rotatably connected to the pump drive shaft, a torque tube rotatably surrounding a section of the pump drive shaft, and a second clutch member non-rotatably connected to the torque tube, whereby fictional engagement between the first and second clutch members upon engagement of the clutch drivingly connects the pump drive shaft to a pump drive gear non-rotatably connected to the torque tube, thereby to enable selective transmission of drive between the vehicle drive shaft and the pump drive shaft.

28. An energy management system according to claim 27, wherein the clutch includes a clutch pack comprising plurality of said first clutch members in the form of first annular clutch plates and a plurality of said second clutch members in the form of second annular clutch plates, the first and second clutch plates being coaxially interleaved for mutual frictional engagement upon engagement of the clutch.

29. An energy management system according to claim 22, wherein the clutch is engaged or disengaged by an actuator.

30. An energy management system according to claim 29, wherein the actuator is of a type selected from the group comprising: mechanical; hydraulic; pneumatic; and electro-magnetic actuators.

31. An energy management system according to claim 22, wherein the clutch is adapted to slip if a predetermined torque threshold is exceeded.

32. An energy management system according to claim 31, wherein the controller is adapted to effect disengagement of the clutch if a predetermined torque threshold is exceeded, or if a predetermined degree of clutch slippage is detected.

33. An energy management system according to claim 9, wherein the transmission mechanism includes an epicyclic gear set disposed coaxially around the pump drive shaft.

34. An energy management system according to claim 33, wherein the epicyclic gear set is selectively operable to provide at least two different transmission ratios and a neutral mode.

35. An energy management system according to claim 9, wherein said transmission mechanism includes a pair of first drive gears of different pitch mounted to the vehicle drive shaft and supported in respective meshing engagement with a complementary pair of second drive gears mounted to said pump drive shaft for selective transmission of drive between said pump drive shaft and said vehicle drive shaft at one of two different transmission ratios.

36. An energy management system according to claim 35, wherein selection between said transmission ratios is controlled by a selector facility having a selector shaft that moves laterally to the axis of said drive gears for movement thereof, permitting selective engagement between said respective pairs of gears on said vehicle drive shaft and said pump drive shaft.

37. An energy management system according to claim 36, wherein said selector shaft is controlled by a solenoid operable pneumatic actuator.

38. An energy management system according to claim 1, wherein said accumulator includes a gas/liquid accumulator adapted to store energy by gas compression and to release energy by fluid emission.

39. An energy management system according to claim 38, including an optical sensor operative when the vehicle drive shaft is stationary, to sense relative movement between selected components of said system indicative of a potentially hazardous depressurisation event, the controller being adapted to discharge said accumulator in response to an ouput signal from said sensor.

40. An energy management system according to claim 39, wherein said optical sensor includes a light source and wherein interruption of light from said light source causes the output signal to be sent to said controller to effect discharge of said accumulator.

41. An energy management system according to claim 1, including a control valve through which fluid can be diverted by the controller when said accumulator is fully

charged, said control valve providing resistance to pumping and thereby enabling the pump to continue to exert a retarding force on the vehicle drive shaft when the accumulator is fully charged.

42. An energy management system according to claim 1, further including a load removal facility for selectively disconnecting the vehicle engine from the vehicle drive shaft at times when the momentum of the vehicle causes the vehicle drive shaft to drive the vehicle engine, said facility including a disengageable coupling positioned between the engine and the pump and being selectively disengageable.

43. An energy management system according to claim 42, wherein said disengageable coupling is operative to slip when said vehicle drive shaft drives said engine and to couple when said engine drives said vehicle drive shaft.

44. An energy management system according to claim 43, wherein said disengageable coupling is selectively lockable against slipping.

45. An energy management system according to claim 44, wherein said disengageable coupling includes a pin movable between a locked and an unlocked position relative to said disengageable coupling, said pin being receivable in bores in respective couplable parts of said engine and said vehicle drive shaft whereby removal of said pin from one of said bores permits disengagement of said coupling.

46. An energy management system according to claim 1, wherein said controller is programmable.

47. An energy management system according to claim 1, wherein said microprocessor includes a programmable logic controller.

48. An energy management system according to claim 1, wherein said controller includes a computer.

49. An energy management system according to claim 1, wherein said controller includes a command module adapted to receive manual inputs from a vehicle operator.

50. An energy management system according to claim 1, wherein said at least one sensor further comprises one or more of: a body roll inclinometer; an incline/decline

inclinometer; a road speed indicator; an accumulator pressure indicator; a turbo boost pressure indicator; an accelerator potentiometer; a brake depression sensor; a brake pressure transducer; a load weight sensor; and a gear change sensor.

51. An energy management system according to claim 1, further including a flow controller adapted to provide a substantially constant retardation force relative to pump flow rate in the retarding mode, substantially independent of the charge state of the accumulator.

52. An energy management system according to claim 51, wherein said flow controller is adapted to maintain substantially constant hydraulic pressure respectively between said pump and said accumulator and between said pump and said reservoir, thereby providing said substantially constant retardation force.

53. An energy management system according to claim 51 or claim 52, wherein said flow controller includes a balanced logic control element.

54. An energy management system according to claim 1, further including a terrain logging facility for memorising and recording road terrain on a vehicle route, said facility including recording means and measuring means, said recording means recording parameters measured by said measuring means relating to the route being travelled.

55. An energy management system according to claim 54, wherein the parameters include one or more of: the distance travelled; the route contour; the vehicle speed; the vehicle load; and the available energy in the accumulator.

56. An energy management system according to claim 54 or claim 55, wherein said facility includes one or more inclinometers to record route contour.

57. An energy management system according to claim 54, wherein said facility includes a means to match recorded travel data with new data being recorded on route and to identify the particular route being travelled, thereby enabling the facility to predict upcoming terrain and to charge and discharge energy from the accumulator efficiently according to the previously recorded data.

58. An energy management system according to claim 57, wherein said new data is added to said recorded travel data to continuously update said recorded travel data in respect of said particular route each time said particular route is travelled.

59. An energy management system according to claim 58, wherein the information recorded by said facility is able to be downloaded for use in a corresponding facility fitted to a different vehicle.